STATEWIDE RAIL PASSENGER PROGRAM

Restoration of Passenger Rail Service

between

Seattle, Washington; and Vancouver, British Columbia

Prepared **for the**

Washington State Department of Transportation

by

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Revised

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TABULATIONS

1. INTRODUCTION

This paper has been prepared by the WSA team at the request of the Washington State Department of Transportation (WSDOT) in order to estimate the capital investment necessary to allow an early re-establishment of conventional Amtrak passenger service over the Burlington Northern line between Seattle, Washington and Vancouver, British Columbia

Other work performed-in connection with the Department's Statewide *Rail Passenger Program* has looked at the upgrades needed on various fine segments to permit higher speeds than those in effect now. This paper has a different purpose: namely, to determine what would be necessary to restore viable passenger service over the currently freight-only trackage between Everett and Vancouver, B.C.

The hypothesis in this analysis is that passenger service would be reinstated between Seattle and Vancouver in the near term, following modest improvements in the existing physical plant, and before a large-scale corridor-long upgrade program begins. The reinstated service would use standard Amtrak diesels and cars, operate at a maximum speed of 79 mph, and consist of one or two trains per day in each direction.

In the past, service has been provided between Seattle and Vancouver with elapsed trip times as fast as 3-3/4 hours. The last regular passenger operation, in 1981, was scheduled at 4-1/2 hours, but this included stops for customs, whereas previous operating practice included on-train customs.

Amtrak has stated that they would like any restored service to achieve elapsed trip times of 3' 30'. Accordingly, we have begun by defining the goal as a physical plant that will support something close to a 3-1/2 hour Seattle-Vancouver trip time. This schedule represents a 'level of utilii' higher than the best historical capability and noticeably higher than the present capability, between Everett and Vancouver.

Consequently, what this paper will describe is not simply a program to 'recover' the lost historical level of utility, but a program that also includes selective elements designed to moderately increase the line capability in order to support the faster timing.

"Level of Utility" is the operating capability or a rail line. and is 3 reflection if its overall ability to support a given schedule.

2. ASSUMPTIONS, TRACK SPEEDS AND SCHEDULE TIMES

Our principle assumptions can be summarized as follows:

- Seattle - Vancouver, B.C. elapsed times need to be in the 3-1/2 hour range for the restored service to be viable:
- The investment program should permit the operation of at least twice-a-day service during 'daylight' hours without degrading the Burlington Northern (BN) freight operation;
- The investment program should recognize the shortage of funds and emphasize 'smart', selective investment in this initial phase rather than a larger, more comprehensive upgrade; and
- Dollars spent to improve reliability are as important to the success of the program as those spent to increase speed.

These general assumptions have shaped our approach to selecting the package of recommended improvements. We have tried to keep the engineering improvements modest, but the desire for a 3-1/2 hour schedule will require a rather intricate set of small projects in order to avoid the need for major capital expenditures.

This approach-a whole series of modest projects which have the cumulative effect of increasing the average train speed-will require close cooperation between the Burlington Northern, the WUTC, Transport Canada, British Columbia, U.S. and Canadian customs and various cities along the route. In the scheme we propose, virtually all segments of the Seattle-Vancouver line require some improvements to either restore historical speed capabilities, or to allow speed capabilities higher than the best historical ones in order to offset areas where the highest previous historical speeds are no longer achievable. In addition, we are trying to build in an improvement of about 15 minutes elapsed running time over the best historical performance: this is not easy to do when one remembers that there is more freight traffic now than 30 or 40 years ago, there is more urban development, more congestion, and there are more limits in the design of superelevated curves because the Everett-Roberts Bank (B.C.) section of the line now sees heavy coal trains, and because track maintenance expenses must be tightly controlled.

In our attempt to balance the competing demands of capital costs, maintenance costs, municipal desires for slower train speeds, freight train operating requirements, bridge conditions, and the desire for a 3-1/2 hour schedule, we have, in line with our general assumptions, adopted the following standards and specific assumptions:

(a) In Seattle, Edmonds, Mt. Vernon, Burlington and Bellingham, we have incorporated *some* relief from the existing municipal or WUTC restrictions that limit passenger trains to 20 or 25 mph. Where we propose raising these limits, we propose reasonable new speeds in the 35-45 mph range. The existing speed limits in Mukilteo and Blaine do not adverseiy affect the proposed passenger train speeds, so we have left them alone; the others, however, must be eased if anything like a 3-1/2 hour schedule is to he practical.

(b) In **Canada, we have projected** an increase in maximum passenger speeds to 60 mph where conditions permit. We have also proposed restoring the historical 50 mph speed in White Rock and we have proposed increasing passenger speeds across the Fraser River Bridge to 10 mph. Generally, our proposed speeds on the Canadian segments turn out to be very much like the historical level of utility. **While it is** not necessary to increase the Canadian speeds significantly above the historical levels in order to make the proposed schedules, it is clear from our analysis that it will be impossible to meet the 3-1/2 hour target unless speeds generally equivalent to the historical levels are restored. There is simply not enough 'slack' in the line on the U.S. side to achieve the goal solely by improving the U.S. portion.

(c) We have assumed on-train customs, and we have assumed no stops in either White Rock or Blaine. This would require customs to ride between Bellingham and New Westminster. We have made this assumption because:

1) The target schedule will not allow stops at all the former intermediate points;

2) We presume it might take customs up to one hour to 'clear' the train anyway; and

3) It may be possible to design a schedule where U.S. and Canadian customs officers may be able to work opposing trains in 'turns' between New Westminster and Bellingham, on schedules that minimize the layover at the 'away' terminal.

(d) For purposes of freight train/passenger train operating and engineering compatibility, we have restricted superelevation in curves to 4-1/2" actual, except on 3 separate curves between Marysville and Fernwood where we proposed 5-1/2" actual elevation in order to minimize time loss to passenger trains resulting from a sharp reduction in speed in the middle of ctherwise higher speed stretches.

(e) We have planned the capital improvement package to require **only one** new movable bridge: a replacement for Bridge 69 over Nicomekl Creek between White Rock and Colebrook. This bridge is presently restricted to 15 mph in a segment that historically allowed 55 mph and which we propose be lifted to 60 mph. The other changes in passenger speeds across movable spans are purposely modest: 30 mph at Ballard, 15 mph over the Snohomish River, 40 across Steamboat and Ebey Sloughs near Marysville, and 10 across the Fraser River. The idea is to keep the investment requirements for these other spans very modest until a more comprehensive, 'high speed' upgrade of the corridor is undertaken.

(f) We have routed the passenger trains via Bayview in Everett, and proposed an upgrade of this line, because it is shorter, more direct, and offers up to five minutes in potential time savings.

Wiih these specific assumptions guiding the plan, we have been able to develop a 3 hour, 35 minute elapsed running time, using current Amtrak diesels and rolling stock and making intermediate stops at Edmonds, Everett, Mt. Vernon-Burlington, Bellingham, and New Westminster.

The proposed segment-by-segment track speeds for the Seattle-Everett line are set forth in Table 1, along with comparative historical segment speeds from 1963 and 1981, the last year of regularly scheduled passenger service.

Table 2 offers a similar comparison speed table for the Everett-Vancouver, B.C. line, via Bayview in the City of Everett.

Table 3 compares historical point-to-point and elapsed running times from 1953 and 1966 with those we believe are practical if the improvement scenario set forth in this paper is fully implemented. We have not included the 1981 schedule because, at 4-1/2 hours, it seems to us to be pointless as a standard of comparison. By contrast, the best historical speeds-which are typified by the 1953 and 1966 schedules—do represent the performance that was once achieved when historical levels of utility were in place. Therefore, these schedules are a 'reality check' on the present analysis. **It is Important,** however, to **recognize that the 1992 conditions are very different than those in 1953 or 1966.**

Table 1

COMPARISON OF HISTORICAL, PRESENT, AND PROPOSED SPEEDS
SEATTLE TO EVERETT JUNCTION
Washington Statewide Rail Passenger Program

Segment	Milepost to Milepost	Distance (in miles)	Miles per Hour				Notes
			1953	1981	1992	Proposed	
SE-1	King St. - 1.9	1.9	20	20	20	35	Tunnel/7°34' Curve
SE-2	1.9 - 3.0	1.1	35	35	35	40	—
SE-3	3.0 - 3.3	0.3	35	35	20	40	—
SE-4	3.3 - 6.0	2.7	35	35	35	40	—
SE-5	6.0 - 6.3	0.3	20	20	20	30	Ballard Bridge
SE-6	6.3 - 8.7	2.4	50	35	35	45	5°20' Curve
SE-7	8.7 - 11.5.	2.8	55	50	45	50	4°12' curve
SE-8	11.5 - 13.3	1.8	60	60	50	60	
SE-9	13.3 - 15.0	1.7	60	50	50	50	4°03' Curve
SE-10	15.0 - 16.7	1.7	60	50	40	50	4°09' Curve
SE-1 1	16.7 - 17.3	0.6	45	50	40	45	5°00' Curve
SE-I 2	17.3 - 17.8	0.5	35	50	40	50	Edmonds
SE-13	17.8 - 20.0	2.2	60	50	40	60	
SE-14	20.0 - 21.8	1.8	60	50	40	50	4°06' curve
SE-15	21.8 - 25.4	3.6	60	50	45	50	4°20' Curve
SE-16	25.4 - 28.5	3.1	60	60	45	60	3 % Curve
SE-I 7	28.5 - Everett Jct.	3.5	60	60	55	60	3°20' Curve
	Total Distance	32.0					

Wilbur Smith Associates: November 1992.

Table 2
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COMPARISON OF HISTORICAL, PRESENT AND PROPOSED TRACK SPEEDS
EVERETT JUNCTION TO VANCOUVER, B.C.
Washington Statewide Rail Passenger Program

Segment	Milepost to Milepost	Distance (in miles)	Miles per Hour				Notes
			1953	1981	1992	Proposed	
EV-1	Everett Jct. - 35.9	3.8(1)	50	N/A	15	50	
EV-2	35.9 - 36.7	0.7(1)	30	N/A	15	30	9°30' curve; 3' superelevation
EV-3	36.7 - 37.2	0.6(1)	10	10	15/10	15	
Ev4	37.2 - 36.5	2.1(1)	20	20	20	40	WUTC
Ev-5	36.5 - 39.5	1.0	25	20	20	40	WUTC
EV-6	39.5 - 41.0	1.5	79	20/25	25	60	—
EV-7	41.0 - 46.9	7.9	79	79	50	79	—
EV-8	46.9 - 50.8	0.9	60	79	50	70	2°36' curve; 5-1/2" superelevation
EV-9	50.8 - 55.1	4.3	79	79	50	79	—
EV-10	55.1 - 56.5	1.4	65	79	50	79	—
EV-11	56.5 - 67.0	10.5	79	79	50	79	—
N-12	67.0 - 66.9	1.9	25	20	20	45	WUTC
EV-13	68.9 - 71.4	2.5	60	20	20	45	—
EV-14	71.4 - 72.4	0.8	25	20	20	45	WUTC
EV-15	72.4 - 74.5	2.1	79	79	50	79	—
N-16	74.5 - 74.7	0.2	45	45	40	50	5°6' curve; 5-1/2" superelevation
Ev-17	74.7 - 76.4	1.7	79	79	50	79	—
EV-18	76.4 - 76.6	0.4	60	79	50	79	
Ev-19	76.8 - 82.5	5.7	75	79	50	79	—
EV-20	82.5 - 93.1	10.6	40	40135125	35	40	7°06' curve: 4-1/2" superelevation
EV-21	93.1 - 93.5	0.4	40	25	20	40	
EV-22	93.5 - 96.2	3.8(2)	30	25	20	35	8°00' curve; 4' superelevation
EV-23	96.2 - 99.3	1.1	45	50	20	50	
EV-24	99.3 - 101.2	1.9	45	50/40	35	50/40	6°12' curve; 4-1/2" superelevation
EV-25	101.2 - 103.4	2.3	55	55	50	50	3°39' curve; 4-1/2" superelevation

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COMPARISON OF HISTORICAL, PRESENT AND PROPOSED TRACK SPEEDS
EVERETT JUNCTION TO VANCOUVER, B.C.
Washington Statewide Rail Passenger Program

Segment	Milepost to Milepost	Distance (In miles)	Miles per Hour				Notes
			1953	1981	1992	Proposed	
EV-26	103.4 - 105.2	1.8	60	60	50	60	—
EV-27	105.2 - 105.8	0.6	50	60	50	60	—
EV-28	105.8 - 106.2	0.4	50	50	40	50	5°09' curve; 5-1/2" superelevation
EV-29	106.2 - 106.6	0.4	70	50	40	70	—
EV-30	106.6 - 108.2	1.6	70	79	50	70	—
EV-31	108.2 - 108.7	0.5	60	79	50	70	2°00' curve; 4-1/2" superelevation
EV-32	108.7 - 117.2	8.5	70	79	50	79	
EV-33	117.2 - 118.4	1.2	50	50	50	50	
EV-34	118.4 - 119.9	1.9(3)	50	50	15	50	
EV-35	119.9 - 121.3	1.4	55	50	30	50	
EV-36	121.3 - 122.7	1.4	55	50	21	60	
EV-37	122.7 - 123.0	0.3	55	50	30	60	
EV-38	123.0 - 127.6	4.6	55	50	40	60	
EV-39	127.6 - 127.9	0.3	55	25	15	60	Bridge69
EV-40	127.9 - 129.9	2.0	55	50	40	60	
EV-41	129.9 - 131.6	1.7	55	50	35	60	
N-42	131.6 - 136.7	5.1	55	50	40	MP 131.6-132.0: 50/132.0-136.7: 60	
EV-43	136.7 - 137.3	0.6	55	50	30	60	
EV-44	137.3 - 139.0	1.7	55	50	40	60	
EV-45	139.0 - 140.8	1.8	40	50	40	60	
N-46	140.8 - 141.5	0.7	6	8	5	10	Fraser River
EV-47	141.5 - 145.5	1.7(4)	35	20	20	35	
N-48	145.5 - 146.8	1.3	55	25	30	55	
w-49	146.8 - 150.1	3.3	55	50120	30	MP 146.8-147.4: 55/147.4-150.1: 60	
N-50	150.1-151.0	0.9	25	20/10	30	60	—

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COMPARISON OF HISTORICAL, PRESENT AND PROPOSED TRACK SPEEDS
EVERETT JUNCTION TO VANCOUVER, B.C.
Washington Statewide Rail Passenger Program

Segment	Milepost to Milepost	Distance (in miles)	Miles per Hour				Notes
			1953	1981	1992	Proposed	
EV-51	151.0-I 53.7	2.7	55	50	30	50	
EV-52	153.7 - 154.0	0.3	35	25	25	Northbound 50/Southbound 50	
EV-53	154.0 - 155.2	1.2	55	25	25	50	
Ev-54	155.2 - Van. B.C.	1.4	35	15	10	25	
	Total Distance	121.4					

(1) Several milepost equations exist between Everett Junction and Marysville.
(2) Equation at Bellingham: Mileposts 94 and 98 are approximately 1.05 miles apart
(3) Mileposts 119 and 120 are about 7,800 feet apart
(4) Equation at north end of Fraser River Bridge: 141.5 = 143.8

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Table 3

HISTORICAL AND PROPOSED PASSENGER SCHEDULES
SEATTLE, WA - VANCOUVER, BC
Washington Statewide Rail Passenger Program

	Elapsed Running *Times in* Minutes		
	1953(1)	1966(1)	Proposed
Northward			
Seattle	---	---	---
Edmonds	30	30	28
Everett	55	53	49
Mt. Vernon(')	97	99	96
Bellingham	136	140	132
New Westminster	209	209	193
Vancouver	235	225	215
Southward			
Vancouver	---	---	---
New Westminster	20	17	20
Bellingham	87	81	80
Mt. Vernon(1)	129	120	116
Everett	180	175	163
Edmonds	202	195	185
Seattle	235	230	215

(1) 1953 schedules stopped at Everett, Mt. Vernon, Bellingham, Blaine, White Rock and New Westminster, but not Edmonds.

1966 schedules stopped at all the 1953 stations plus Edmonds, and operated via P.A. Jct. in Everett.

The proposed schedules would stop at Edmonds, Everett, the 'new' Mt. Vernon/ Burlington, Bellingham, and New Westminster, but not at Blaine or White Rock. The proposed operation is once again via Bayview at Everett.

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3. SPECIFIC. IMPROVEMENTS WITH COST ESTIMATES

This list of improvement projects, and the associated cost estimates, modify the lii of improvements and cost estimates originally included in the WSA January **7, 1992** *Statewide Rail Passenger Program.*

The principal differences between the two sets of projects and estimates are:

- The present estimates allow for investment to recover the lost historical level of utility between Everett and Vancouver, B.C.;
- Some projects originally described in the January 1992 Report have been redefined in the present study to better focus on the desire for an early restart of Seattle-Vancouver, B.C. service; and
- Allowance is made in the present analysis for track capacity expansion investment needed to avoid freight train interference.

Table **4** lists the unit costs used in the project estimates. All estimates include **40** percent contingency and 15 percent engineering. Signal costs are project specific. All 'SE' projects are located between Seattle and Everett Jct. All "EV" projects are located between Everett Jct. and Vancouver, B.C. Projects are listed sequentially in order from Seattle to Vancouver, B.C.

Table 5 lists all the proposed projects, including those intended to mitigate freight train interference and those intended to improve grade crossing protection, as well as the projects intended to improve track speeds.

Additional freight-related support trackage is proposed for Burlington, Bellingham, Intalco and Brownsville. BN has indicated there may not be sufficient room for these site-specific track expansions, and has suggested consolidating the increased switching capacity at Conway. This option is covered in Section **4,** Burlington Northern Comments. One new bridge is proposed, namely Bridge 69 over Nicomekl Creek between White Rock and Colebrook. CTC is proposed for the segments between Townsend and South Bellingham, between Willingdon Jct. and Vancouver depot, and between Everett Jct. and Delta Jct. Otherwise, the proposed investment generally represents tie and surfacing work, improvements at public crossings, improvements to curve elevation, and selected extensions of double track through the currently single track sections between Seattle and Everett.

Table 4

UNIT COSTS IN 1992 DOLLARS
Washington Statewide Rail Passenger Program

Item	Unit	Unit Cost
New Trackwork (136# Rail)	Per Track Foot	$140.00
New Siding (Relay Rail)	Per Track Foot	$130.00
Upgrade Track (including rail)	Per Track Foot	$135.00
Ties and Surfacing(1)	Per Track Mile	$1 00,000.00
No. 20 Turnout	Each	$1 00,000.00
No. 24 Turnout	Each	$125,000.00
Align Track	Per Track Foot	$20.00
Remove Turnouts	Each	$2,500.00
Install Grade Crossing	Per Crossing	$400.00
Earthwork	Per Cubic Yard	$5.00 - $10.00
Extend Culverts	Per Linear Foot	$100.00
Increase Superelevation	Per Track Foot	$2.50
Install Electric Locks	Each	$60,000.00
Power Crossovers	Each	$180,000.00
Adjust Grade Crossing Circuits/Predictors	Per Crossing	$10,000 single track $20,000 double track
New Grade Crossing Signals (Fl&g) Relocate Crossing Signals	Per Crossing	$75,000 single track 5140,000 double track
Contingency	Per Estimate	40%
Engineering	Per Estimate	15%

(1) Assumes 500 ties per mile at $48.00 each, and 5,280 feet of ballast at $15.00/TF.

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CAPITAL COST ESTIMATES - SEATTLE, WASHINGTON TO VANCOUVER, BRITISH COLUMBIA
Washington State "GAP" Study

Segment(1)	Milepost to Milepost	Work Required	Estimated Cost	Total
SE 1	0.0 - 1.9	Surface both tracks.	$ 380,000	
		Adjust 5 crossing predictors.	100,000	
		Adjust elevation, Curves C1-C10 (0.9 miles).	12,000	$ 492,000
SE 2/3	1.9 - 3.3	Surface both tracks.	$ 140,000	$ 140,000
SE 4	3.3 - 6.0	Upgrade old NP Main near Garfield St. and 23rd Street to main track; make track A into a controlled running track.	$1,660,000	
		Adjust Gaylor St. predictors.	20,000	
		Revise ABS* signals Garfield and 23rd Streets to protect movements with current of traffic on main track: power crossovers Gaylor St. and 23rd St.	5,900,000	$ 7,580,000
SE 5	6.0 - 6.3	Modify Mitre on lift end of Ballard Bridge to allow passenger spcod of 30 mph.	$ 120,000	
		Surface both tracks.	30.000	$ 150,000
SE 6	6.3 - 8.7	Connect two maln tracks MP 7.4 and two main tracks, MP 7.7. Ftomovo ono equilateral and one convoniional turnout and roplaco wlth ono universal crossover.	$ 600,000	
		Surface both tracks.	250,000	
		Extend CTC* limits to now universal crossover at approximately MP 7.5	170,000	$ 1,020,000
SE-7	6.7 - 11.5	Surface and superelevate 4° + curves for 50 mph	$ 560,000	$ 560,000
SE 8/9	11.5 - 15.0	Superelevate curves between MP 11.5 and 13.3 for 60 mph.	$ 7,500	$ 7,500

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CAPITAL COST ESTIMATES - SEATTLE, WASHINGTON TO VANCOUVER, BRITISH COLUMBIA
Washington State "GAP' Study

Segment(1)	Milepost to Milepost	Work Required	Estimated Cost	Total
SE 10/12	15.0 - 17.8	Extend double track 1.9 miles between MP 15.9 and MP 17.8. Remove one eauilateral and one conventional turnout.	$1,405,000	
		Realign existing main track to become Track 1.	200,000	
		Station platform work.	50,000	
		Install one universal crossover near MP 15.9 nnd revise CTC signals at MP 15.9 accordinalv.	2,360,000	
		Adjust 2 sets crossing predictors.	40,000	$ 4,055,000
SE-13/16	17.8 - 28.5	Revise suporelovation to permit 60 mph MP 17.820; 50 mph MP 20-25.4; and 60 mph MP 25.4-28.5	$ 400,000	
		Connect ends of double track MP 27.0 and MP 27.8, Mukilteo. Revise CTC signals.	4,100,000	$ 4,500,000
SE-17	28.5 - Everett Jct.	Adjust superelevation, Curvos C29A-C31.	$ 45,000	$ 45,000
			Subtotal, Seattle to Everett Junction	$18,549,500
EV 1/2	Everett Jct. - 36.7	Upgrado 4.5 miles single main track to FRA Class IV; edd 8,000' siding west of Delta Junction	$ 4.248.000	
		Install 8 electric locks.	480,000	
		Extend CTC 4.9 mltes between Everett Jct. and Delta Jct.	3,400,000	
		Grade crossing protection for 8 crossings.	600,000	
		Expand Delta Yard to accommodate transfer of switching from Bayside - add two 7,000' tracks and five 3,500' tracks	4,100,000	$12,828,000

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CAPITAL COST ESTIMATES - SEATTLE, WASHINGTON TO VANCOUVER, BRITISH COLUMBIA
Washington State "GAP" Study

Segment(1)	Milepost to Milepost	Work Requlred	Estimated Cost	Total
EV-3	36.7 - 37.2	Surface and lino track around west lag of wye, Delta Junction.	$ 60,000	
		Increase passenger speed over Snohomish River Bridge to 15 mph.	---	$ 60,000
EV-4/6	37.2 - 41.0	Surface track.	$ 380,000	
		Adjust protection, 6 public and 1 private crossing.	70,000	$ 450,000
EV-7/11	41.0 - 67.0	Spot tie and surfacing work as required (30%)	$ 750.000	
		Adjust predictors, 8 existing protected public crossings.	80,000	
		Install gates and flashors at 14 existing unprotected public crossings	1,050,000	$ 1,880,000
EV 12/14	67.0 - 72.4	Surface track.	6 540,000	
		Adjust predictors at 11 public crossings.	110,000	
		Install gates and flashers at 2 unprotected crossings.	150,000	
		Add 6,000 track feet secondary trackage at Burlington to provide for switching	780,000	$ 1,580,000
EV 13/19	72.4 - 02.5	Spot tie and surfacing work as requirod (30%).	$ 300,000	
		Adjust predictors at 6 public crossings.	60,000	
		Install gates and flashers at 5 public crossings.	375,000	$ 735,000
EV 20	82.5 - 93.1	Adjust superelevation to allow 40 mph around curves up to 7°06' (4-1/2" actual, approximately 20,000 track feet)	132,000	
		Adjust predictors, 1 crossing: add gates, 1 crossing.	85,000	$ 217,000

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CAPITAL COST ESTIMATES - SEATTLE, WASHINGTON TO VANCOUVER, BRITISH COLUMBIA
Weshington Stale "GAP" Study

Segment(1)	Milepost to Mileposl	Work Required	Estimated Cost	Total
EV21/22	93.1 - 98.2	Surface and adjust elevation of track.	$ 510,000	
		Extend CTC between S. Bellingham and MP 98.2; install 12 electric locks.	1,750,000	
		Install crossing protection at 9 public crossings.	675,000	
		Adjust protection et 2 crossings.	20,000	
		Extend north lead to Bellingham Yard 6,000 feet to north.	780,000	$ 3,735,000
EV23/24	98.2 - 99.3	Surface and adjust superelevation all curves over 3°.	$ 110.000	$ 110,000
EV 25/33	99.3 - 118.4	Surface MP 99.3 - 101.2 and spot tie nnd surface balance (30%).	$ 705,000	
		Adjust superelevation, all curves over 3" (raise to 5-1/2" Curve C-106, Ferndale) 20.000 linear feet.	52,000	
		Adjust predictors et 14 public crossings.	140,000	
		Install gales and flashers, 2 public crossings.	150,000	
		Add 10,000 track feel support trackage at Custer, Intalco or Cherry Point to permit local freight operation to clear main track.	1,300,000	
		Extend CTC between MP 98.2, Bellingham, and MP 119.6, Bloino. Place, Ferndale and Blaine in CTC control system; Install electric locks, Custer and Intalco.	3,700,000	$ 6,047,000
EV34/35	110.4 - 121.3	Surface track.	$ 290,000	
		Adjust superelevation all curves over 3" (4-1/2").	7,000	
		Blaine: Install gales dnd flashers, 1 crossing. While Rock: Install fencing and pedestrian subways.	120,000	$ 417,000

Table 5
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CAPITAL COST ESTIMATES - SEATTLE, WASHINGTON TO VANCOUVER, BRITISH COLUMBIA
Washington State "GAP" Study

Segment(1)	Milepost to Milepost	Work Required	Estimated Cost	Total
EV 36/40	121.3 - 129.9	Surface track.	$ 860,000	
		Adjust superelevation, ail curves over 3".	10,000	
		Replace Bridge 69 (1,585 feet @ $5,000/linear foot).	7,525,000	
		Extend CTC between MP 119.6. Biaine; and MP 130.8, Colebrook.	2,500,000	
		Adjust predictors at 2 crossings; add protection at 1 crossing.	95,000	$11,080,000
EV 41/43	129.9 - 137.3	Surface track.	$ 750,000	
		Adjust superolevntion, Curvo C-131 Colebrook.	7,000	
		Adjust one crossing predictor.	10,000	
		Extend CTC MP 131.5 Colebrook to MP 137.3 Townsend.	1,600,000	$ 2,367,000
EV 44/45	137.3 - 140.8	Surface track.	$ 350,000	
		Adjust 2 orossing predictors.	20,000	
		Construct new 6,500' controlled siding on east side of main track, Brownsville.	1,045,000	$ 1,415,000
EV 46/47	140.0 - 145.5	incronse speed across Fraser River Bridge to 10 mph.	$ ---	
		Surface track and adjust superelevation, all curves over 3°.	250,000	
		install gates and flashers at 3 crossings; New Westminster, adjust predictors at 1 crossing.	235,000	$ 485,000

Table 5
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CAPITAL COST ESTIMATES - SEATTLE, WASHINGTON TO VANCOUVER, BRITISH COLUMBIA
Washington State "GAP" Study

Segment(1)	Milepost to Milepost	Work Required	Estimated Cost	Total
EV 48/53	145.5 - 155.2	Spot lie and surfacing, both tracks (30%); adjust superelevation curves over 3°.	$ 625,000	
		Extend CTC MP 151 .9 - 156.0; install #20 turnout north end D.T. Still Creek.	2,700,000	
		Adjust protection al 8 crossings: Install gates at 2 crossings.	180,000	$ 3,505,000
EV.54	155.2 - Vancouver	Surface and align throat tracks to depol; install power switch at south end depot tracks.	$ 160,000	$ 160,000
		Subtotal, Everett Junotion to Vancouver, B.C.		$47,071,000
		Total: Seattle, Washington to Vancouver, British Columbia		$65,620,800

(1) Segments from Tables 1 and 2.

ABS = Automatic Block Signal System.
CTC = Contraiized Traffic Control.

Wilbur Smith Associates; November 1992.

4. BURLINGTON NORTHERN COMMENTS

In reviewing the original draft of this analysis, operating personnel from the BN suggested some changes to our original recommendations for improvements to mitigate freight train delays.

Some of the suggestions-particularly those that would alleviate freight interference problems on the Bayside line in Everett, and increase capacity in the area between Garfield and 23rd Streets in Seattle-have been costed and incorporated in the estimates in Table 5.

The other items on the BN 'wish list' speak to capacity issues which we have not been able to assess. These projects may 'well be justifiable; we would recommend that WSDOT and/or BN commission a more specific, computer-model simulation of the proposed train operations between Everett and Vancouver, B.C. if it is desirable to know exactly what would be required to relieve potential congestion in this area.

Otherwise, we believe the added improvements listed below should be the subject of discussion between the State and the BN. In some cases, these improvements would take the place of those set forth in Table 5, so there would be a cost tradeoff between relieving congestion the 'BN way' and relieving it 'our (the consultant's) way. If the costs turn out to be equal, our general premise would be to do it the railroad's way-they know their operation best.

So, in addition to the projects proposed in Table 5, the BN would like to see the Vancouver, B.C. line enhanced with the following additional improvements.

1. Flexibility to handle increasing unit train operations on line. Train lengths require 7,000' sidings, but BN would prefer 9,000' to allow reasonable stopping distances at speeds higher than 10 mph.

2. For the operation of passenger trains between Everett Junction and Delta Junction via Bayside (and the removal of freight activity to Delta Yard line except for local switching) BN would like:

    - Dispatcher-controlled interlockings at BN Jct. and C Line Jct. to facilitate flow of traffic via Delta, and avoid hand-lining of switches, etc.

3. A future extension of the siding at English to Marysville (6 miles) if traffic volume continues to increase.

4. A new lo-track yard, including a 7,000' track to allow trains to set out or pick up without occupying main track, near Conway at MP 63. This yard would support Burlington, Bellingham, Ferndale, and Italco and relieve congestion caused by holding cars at those points. It would replace the proposed capacity improvements at those points listed in Table 5.

5. A controlled absolute signal on either side of the yard area at Bellingham as part cf the CTC installation to facilitate switching off the main track.

6. Dual control CTC switches at the south end of Burlington yard and main track crossovers, together with a drill signal governing movement between the siding and the south end of yard to permit switching while avoiding delays to through trains approaching the siding. **Also,** the switch from the main track to the Anacortes Line should be a dual controlled CTC switch.

Burlington Northern also indicates that the proposed addition of second main tracks between MP 16 and 18 and MP 27 and 28 may involve significant filling and grading in defined wetland areas and **is** likely to be more expensive than estimated in our study.

5. SUMMARY

The capital projects set forth in this analysis would permit at least two passenger trains to be operated each way daily between Seattle and Vancouver, B.C. in addition to the present Amtrak and BN freight trains. If all the projects were implemented as described, and the track speeds raised to a least the levels set forth in the tables included in this report, it should be possible to achieve a 3 hour, 35 minute elapsed running time and acceptably consistent performance, with no overall decay in the BN's freight performance.

The projects described and estimated in this report include much of the work originalty recommended in WSA's January, 1992 *Statewide* Rail *Passenger Program*. That analysis assumed, however, that the Everett-Vancouver, B.C. section of the route was already at a 'normal' FRA Class IV level of utility much like the historical capability.

This analysis specifically includes the investment necessary to recapture the lost historical level of utility, particularly between Everett and Vancouver, as well as the investment needed to achieve elapsed schedules close to 3-1/2 hours.